REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

Claims 1, 2, 5, 6, 8, and 9 were rejected under 35 U.S.C. 102(b) as being anticipated by Hattori et al. (US 2003/0009259). The rejections are traversed for the following reasons.

Claim 1 defines a control device for generating a desired gait of a legged mobile robot that travels by moving a plurality of legs extended from its body. The control device includes a slippage determining means, a permissible range setting means, a provisional motion determining means, and a provisional motion correcting means. Relevantly, the permissible range setting means of claim 1 is a means for variably setting a permissible range of a restriction object amount according to a determination result of the slippage determining means.

Hattori is cited for teaching a control device of a legged mobile robot. The control device of Hattori includes a means for determining slippage of the robot. More specifically, the determined slippage triggers a correction once the slippage passes a threshold value. Once the slip is determined, the control device of Hattori seeks to correct the gait of the legged robot. In other words, if the slippage passes the threshold value, the gait has to be corrected each time under the same slippage conditions.

However, the means for determining slippage in Hattori does not verify the

threshold value while slippage is occurring. The permissible range setting means of the control device of claim 1 narrows the permissible range of the restriction object amount depending on a determination result of the slippage determining means so that remedy the slippage sooner than the device taught in Hattori. More specifically, with the control device of claim 1, upon an actual slip of the robot, the motion of the robot is corrected so as to immediately restrain the slippage. Further, if it is determined that a slippage has occurred, then the permissible range is set to be narrower, thereby preventing a subsequent slippage under the same slippage conditions. U.S. Publication 2006/0173578, [0028].

Thus, by narrowing the permissible range of the restriction object, the control device of claim 1 prevents slippage from occurring again under the same slippage conditions. As this feature of claim 1 is not taught by Hattori, it is submitted that claim 1 is not anticipated by the Hattori reference. Reconsideration and withdrawal of the rejection of claim 1 is requested. Claims 5 and 6 depend from claim 1 and are therefore also considered allowable over the art.

Claim 2 is an independent claim directed to a control device that includes the permissible range setting means and patentable features related thereto of claim 1. Claim 2 is therefore considered allowable over Hattori for the same reasons as claim 1. Reconsideration and withdrawal of the rejection of claim 2 is requested. Claims 8 and 9 depend from claim 2 and are also considered allowable over the art.

Claims 3, 4, 7, and 10 – 16 were rejected under 35 U.S.C. 103(a) as being unpatentable over Hattori in view of Takenaka et al. (U.S. Patent No. 6,289,265). The rejections are traversed for the following reasons.

The invention defined in claim 3 is directed to a control device of a legged

mobile robot adapted to sequentially determine an instantaneous value of a desired motion of the legged mobile robot. The control device uses a dynamic model that expresses a relationship between a motion of the robot and a floor reaction force, and also controls the operation of the robot so as to make the robot follow the determined instantaneous value of the desired motion.

The control device of claim 3 includes a slippage determining means, a permissible range setting means, and a desired instantaneous value determining means. The desired instantaneous value determining means determines a new instantaneous value of the desired motion such that a restriction object falls within the permissible range and approximates zero. The desired instantaneous value determining means is determined based on the difference between a desired state amount of the posture of the robot and an actual state amount of the posture of the robot. The desired state amount of a posture of the robot corresponds to the determined instantaneous value of the desired motion.

The above mentioned restriction object amount is related to the determination result of the slippage determining means. The permissible range setting means variably sets a permissible range of the restriction object amount. Thus, the desired instantaneous value determining means determines the new instantaneous value of the desired motion with an aim toward correcting slippage of the robot, the occurrence of which is determined by the slippage determining means.

Accordingly, the desired instantaneous value determining means is inseparably tied to both the slippage determining means and the permissible range setting means. Particularly, the desired instantaneous value determining means determines a new instantaneous value of the desired motion with an aim toward

setting the restriction object (which is related to robot slip) within a permissible range.

A discussed above, Hattori is generally cited for teaching a robot control device that detects a slip and attempts to correct the slip. However, the Examiner concedes that the Hattori reference fails to teach the desired instantaneous value determining means of claim 3. To remedy the shortcomings of Hattori in regards to claim 3, the Examiner cites to Takenaka.

Takenaka teaches a system for controlling a legged mobile robot, the system including a gait generating means. However, the Takenaka patent is not concerned with the slippage of the robot. Rather, Takenaka is merely concerned with a robot posture as a robot traverses an inclined path. As such, to the extent that Takenaka discloses a means for determining an instantaneous value of a desired motion based on the difference between a desired posture and an actual posture, the means is only concerned with differences that arise as a result of the robot traversing an incline. The means do not consider the slippage of the robot, nor do the means make the determination based on the correcting or reducing the slippage of the robot.

As such, contrary to the Examiner's position, Takenaka fails to remedy the shortcomings of Hattori. Particularly, Takenaka, and therefore the combined references, fail to teach or suggest a "desired instantaneous value determining means for determining ... a new instantaneous value of the desired motion such that the restriction object amount ... falls within the permissible range", as required by claim 3.

Therefore, the combined references fail to teach or suggest each and every

feature of claim 3, and a *prima facie* case of obviousness in support of the rejection of claim 3 has not been established. Further, claims 11 – 13 depend from claim 3 and are also considered to be allowable over the art.

The invention defined in claim 4 is similar to that of claim 3, with the added feature that a desired floor reaction force is considered. As with claim 3, claim 4 defines a desired instantaneous value determining means. Thus, the arguments presented above in favor of the patentability of claim 3 are considered relevant to claim 4. For the sake of brevity, the arguments will not be repeated, but are hereby incorporated by reference.

Accordingly, as with claim 3, claim 4 recites features that are not taught or suggested by the cited art. As such, a *prima facie* case of obviousness in support of the rejection of claim 4 has not been established. Further, claims 14 – 16 depend from claim 4 and are also considered to be allowable over the art.

The invention defined in claim 7 includes all of the features of original claim 1. Further, claim 7 defines the slippage determining means as determining an occurrence of slippage based on a result obtained by passing an actual floor reaction force acting on a leg in contact with the ground through a band-pass filter having a frequency characteristic in a range near a predetermined frequency.

The Examiner concedes that Hattori fails to teach or suggest the particular slippage determining means defined in claim 7, and therefore cites to Takenaka for teaching said means. Takenaka teaches a low-pass filter for determining a floor reaction force moment. However, as has been mentioned above, Takenaka is not concerned with the occurrence of slip. The low-pas filter of Takenaka is a means for determining a moment about the reaction force of the robot foot as the robot

traverses an inclined path. Takenaka does not disclose that the low-pass filter is or can be used to determine the occurrence of a slip.

Accordingly, the defined slippage determining means of claim 7 is not taught or suggested by the combined references. In this regard, it is further submitted that the disclosure of the use of a low-pass filter to detect a moment about a robot foot does not, even when viewed in the context of slippage, render the use of said low-pass filter obvious in determining the occurrence of slippage. Slippage, as opposed to an angled incline, is a dynamic action necessarily involving the motion of the robot's foot. Teaching a means for detecting when a foot steps on an angled surface does not render obvious that said method could be used for detecting the motion of the foot once the foot contacts the ground.

As such, the combined references fail to teach or suggest the use of a band-pass filter for the determination of an occurrence of slip. Thus, as this feature is required by claim 7, a *prima facie* case of obviousness in support of the rejection of claim 7 has not been established.

With further reference to claims 11 and 14, the inventions defined therein depend from those defined in claims 3 and 4, respectively. The claims further recite that the slippage determining means determines an occurrence of a slippage based on the ground speed of a distal portion of a leg in contact with the ground. As discussed above, Hattori does not teach or suggest a means for determining an occurrence of slippage based on the ground speed of a distal portion of the leg in contact with the ground. Further, Takenaka is not concerned with determining an occurrence of slippage, and therefore is silent as to this feature.

Thus, the combined references fail to teach or suggest this feature of claims

11 and 14. Accordingly, notwithstanding the patentability of claims 3 and 4, claims 11 and 14 are considered to be independently allowable over the cited art.

With further reference to claims 12 and 15, the inventions defined therein depend from those defined in claims 3 and 4, respectively. The claims further recite that the slippage determining means determines an occurrence of a slippage based on an apparent spring constant, and further based on a temporal changing rate of an actual floor reaction force acting on a leg in contact with the ground and the ground speed of a distal portion of the leg. As discussed above, Hattori does not teach or suggest a means for determining an occurrence of slippage based on an apparent spring constant (see section I., discussion of patentability of claim 1). Further, Takenaka is not concerned with determining an occurrence of slippage, and therefore is silent as to this feature.

Thus, the combined references fail to teach or suggest this feature of claims 12 and 15. Accordingly, notwithstanding the patentability of claims 3 and 4, claims 12 and 15 are considered to be independently allowable over the cited art.

With further reference to claims 13 and 16, the inventions defined therein depend from those defined in claims 3 and 4, respectively. The claims further recite that the slippage determining means determines an occurrence of a slippage based on a result obtained by passing an actual floor reaction force acting on a leg in contact with the ground through a band-pass filter having a frequency passing characteristic in a range near a predetermined value. As discussed above in regards to claim 7, the combined references fail to teach or suggest a slippage determining means using a band-pass filter. The argument presented therein is applicable to claims 13 and 16, and is hereby incorporated by reference.

Thus, the combined references fail to teach or suggest this feature of claims 13 and 16. Accordingly, notwithstanding the patentability of claims 3 and 4, claims 13 and 16 are considered to be independently allowable over the cited art.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. SAT-16312.

Respectfully submitted,

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